

9/30/03

Specification
for the
Crane for Aircraft and Boats

1.0 SCOPE

1.1 Scope. This system specification establishes the general, operational and performance requirements for a commercial crane to replace the Boat and Aircraft (B&A) and Mobile Crash Crane (CVCC) on all Nimitz class aircraft carriers (CVN 68) and newer, hereinafter referred to as the Crane for Aircraft and Boats (CV Crane). The CV Crane is intended to provide a more versatile crane, capable of performing the requirements of a Boat & Aircraft Crane and Mobile Crash Crane. Requirements listed herein are either threshold requirements that are minimum acceptable requirements or objective requirements that include desired capabilities above threshold requirements.

1.2 Classification. The CV Crane described within is intended for use aboard CVN 68 and newer aircraft carriers as the sole crane for hoisting boats and aircraft.

2.0 APPLICABLE DOCUMENTS

2.1 General. Documents listed below are referred to in Sections 3 and 4 of this performance specification. Documents referred to for additional information or as examples are not included; nor are documents referred to in sections other than Sections 3 or 4. Every effort has been made to ensure that the applicable document list is complete. However, caution must be exercised, as all requirements specified within Sections 3 and 4 of this performance specification must be fulfilled even if the document is not listed.

2.2 Government documents.

2.2.1 Specifications, standards, and handbooks.

SPECIFICATIONS, FEDERAL

A-A-52550	- Pintle Assembly, Towing, Manual Release, 18,000, 40,000 and 100,000 LBS Capacity
RR-W-410	- Wire Rope and Strand
VV-F-800	- Fuel Oil, Diesel

STANDARDS, FEDERAL

FED-STD-595	- Colors used in Government Procurement
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DEPARTMENT OF DEFENSE

MIL-STD-209	- Interface Standards for Lifting and Tiedown Provisions
MIL-STD-461	- Requirements for the Control of Electromagnetic Interface Characteristics of Subsystems and Equipment
MIL-STD-810	- Environmental Engineering Considerations and Laboratory Tests
MIL-S-901	- Shock Tests, H.I. (High-Impact) Shipboard Machinery Equipment, and Systems, Requirements for
MIL-DTL-5624	-Turbine Fuel, Aviation, Grades JP-4 and JP-5
MIL-DTL-15024	- Plates, Tags and Bands for Identification of Equipment, General Specification for
MIL-DTL-83133	- Turbine Fuel, Aviation, NATO F-34(JP-8)

HANDBOOKS

MIL-HDBK-235-2	- Electromagnetic Radiation Environment from Friendly or Own Force Emitters
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(Unless otherwise indicated, copies of the listed government specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia, PA 19111-5094)

2.3 Non-Government publications. The following standard forms a part of this document to the extent specified herein. Unless otherwise specified, the current revision of the documents adopted by DoD are those listed in the revision of Department of Defense Index of Specifications and Standards (DoDISS) cited in the solicitation. Furthermore, if the revision of the document is not listed in the DoDISS, the current revision is the revision cited in the solicitation.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.5	- Mobile and Locomotive Cranes
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SOCIETY OF AUTOMOTIVE ENGINEERS (SAE)

SAE AS81807	- Marking of Aircraft Ground Support Equipment with Retro-Reflective Material, Process for
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2.4 Order of precedence. In the event of a conflict between the text of this document and a reference cited herein, the text of this document takes precedence. Nothing in this document, however, supercedes applicable laws and regulations unless a specific exemption has been obtained.

3.0 REQUIREMENTS

3.1 Commercial standard. The crane shall meet the requirements of ASME B30.5-2002 and the requirements of this document.

3.2 Interface. The CV Crane shall interface with the existing Nimitz class (CVN 68) and newer aircraft Flight Deck configurations. The CV Crane shall be capable of boat hoisting tasks required of the B&A Crane and shall meet the needs of the fleet with regards to aircraft crash and salvage without modification to the ship's structure.

3.3 Performance / General Requirements.

3.3.1 Fail-Safe. The crane shall be provided with interlocks, safety devices, and protective features so that it shall be fail-safe. Fail-safe is defined as a failure of the operating power source or power operated drive mechanism shall not jeopardize the safety of the personnel, the load being handled, or the system itself.

3.3.2 Hoist drive. (Threshold requirement) The crane shall hoist or lower a 70,000-pound load at minimum outreach, while the crane is subjected to the dynamic effects of the ship's motion as described in paragraph 3.4.2, at variable speeds. The maximum speed shall be between 60 and 100 feet per minute .

3.3.3 Aircraft Hoisting Capacities. The CV Crane shall be able to obtain a minimum hook height of 27 feet while providing the outreach and capacity to lift the aircraft in tables 3-2. The boom shall have a design / configuration such that will provide sufficient clearance for the aircraft to be handled. In order to achieve this the crane boom shall have the minimum clearance heights at the distances from the front or rear of the crane as shown Table 3-1 while the crane is able to lift all aircraft in Table 3-2 at the outreaches and weights listed in Table 3-2.

Clear Outreach from Front or Rear of Crane [ft]	Minimum Boom Clearance Height [ft]
4	10
10	20
15	23

TABLE 3-1: Minimum Boom Clearance

3.3.3.1 Aircraft Hoisting, Traveling and Slewing (Threshold Requirements). The CV Crane shall be capable of hoisting and traveling at the Hoist & Travel Weights for all aircraft listed in Table 3-2. The CV Crane shall be capable of hoisting and slewing 360 degrees or hoisting and traveling at the Hoist & Slew weights all aircraft listed in Table 3-2. The CV Crane shall be capable of hoisting and moving aircraft listed in Table 3-2 anywhere on the aircraft carrier flight deck in the conditions described in 3.4.2. The rotation speed shall be variable up to 1 revolution per minute

Aircraft Type	Clear Outreach from Front or Rear of Crane [ft] (Not Center of Rotation)	Hoist & Travel Weight [lbs]	Hoist & Slew Weight [lbs]	Sail Area* [sq. ft]
T-45	7	13,510	13,510	N/A
H-60	7	22,700	22,700	N/A
F/A-18C/D	12	33,300	37,700	N/A
F/A-18E/F	14	44,700	57,800	510
EA-18G	14	48,700	57,800	510
JSF	14	44,700	59,100	350
EA-6B	15	46,500	52,853	540
S-3	16	38,900	46,800	N/A
V-22	18	46,900	46,900	530
C-2	18	47,880	47,880	650
E-2	18	47,880	47,880	650

***Note:** It will be assumed that if the CV Crane is capable of lifting the aircraft with sail area listed under the conditions in paragraph 3.4.2 it will also be able to lift the aircraft with N/A list for the sail area.

TABLE 3-2: Aircraft Characteristics (Aircraft Carrier)

3.3.3.2 Aircraft Hoisting, Traveling and Slewing (Objective Requirements). It is desired the CV Crane be capable of hoisting and traveling with an aircraft weighing 52,650 lbs at an outreach of 18 ft from the front or rear of the crane (not center of rotation) and safely roll a minimum of 600 feet without damage to the CV Crane. It is also desired the CV Crane be able to hoist an aircraft weighing 63,140 lbs at an outreach of 14 ft from the front or rear of the crane (not center of rotation) and safely slew 360 degrees.

3.3.4 Boat Hoisting Capacities. The CV Crane shall be capable of hoisting all ship's boats listed in Table 3-3. The CV Crane shall be capable of launching/recovering all ship's boats to and from the water. The crane shall be capable of lowering each boat over the side with a deck edge clearance of not less than three feet while the boat is parallel to the deck edge. The CV Crane shall be able to slew all boats at the weights and outreaches listed in Table 3-3 360 degrees.

Boat Function	Clear Outreach from Front or Rear or Side of Crane [ft] (not center of rotation)	Length [ft-in]	Beam [ft-in]	*Weight [lbs]	Sail Area [sq. ft]
Captains Gig 26 ft MK-7 PE (1990)	14	26 ft-3 in	9 ft-4 in	9,500	166
Admirals Barge 12m PE (1997)	15	39 ft-11 in	11 ft-10 in	18,960	363
Captains Gig 33 ft MK 7 (1990)	14	32 ft-9 in	10 ft –11 in	15,700	264
Utility Boat 12m UB (1992)	15	39 ft-11 in	11 ft-10 in	15,432	287
Utility Boat 50 ft UB MK 7 (1988)	17	50 ft-3 in	14 ft-10 in	24,000	400
NSW RIB 11m (1997)	15	36 ft-1 in	11 ft-7 in	20,000	182

***Note: There will 500 lbs of slings / rigging in addition to the boat weights listed above.**

TABLE 3-3: Boat Characteristics

3.3.4.1 Boat Hoisting Capacities (Threshold Requirements). With the CV Crane on the flight deck, the crane shall be capable of launching and recovering boats listed in Table 3-3 to and from Aircraft Elevator No. 3 while the elevator is at the hangar deck level in the conditions described in 3.4.2.

3.3.4.2 Boat Hoisting Capacities (Objective Requirements). It is desired that with the CV Crane on the flight deck, the crane shall be capable of launching and recovering a boat weighing 26,200 lbs at an outreach of 17 ft to and from Aircraft Elevator No. 3 while the elevator is at the hangar deck level in the conditions described in 3.4.2.

3.3.5 Rated Load. For purposes of this specification the rated load of the CV Crane shall be defined as the load the can be safely lifted while the crane is used shipboard and subjected to the ships motion and wind as specified in paragraph 3.4.2. This shall be determined with the boom, crane and load are at the most severe orientation relative to the wind and horizontal acceleration as specified in paragraph 3.4.2. This approach shall be used for determining all load / outreach combinations specified in the load chart and programmed into the Rated Capacity Limiter (RCL). This is for shipboard operator simplicity and is recognized as being different from the rated load definition of ASME B30.5.

3.3.5.1 Rated Capacity Limiter (RCL). The CV Crane shall include a load limiting system to prevent operations outside of the crane's capabilities. The load limiting system shall sound an audible and visual alarm at 90-percent of the rated load at that outreach. The system shall also prevent operation of the crane when loads and outreach are in excess of 100-percent of the crane's rated load.

3.3.6 Duty cycle. The CV Crane duty cycle is 12 hours per day for 180 days. The crane is expected to be at idle 95-percent of the duty cycle. The crane shall be operational during this time with only daily routine maintenance required. The CV Crane shall also be capable of operating at surge conditions of 24 hours per day for 4 days continuous, with only daily routine maintenance and refueling.

3.3.7 Electromagnetic compatibility. The CV Crane shall meet the requirements of MIL-STD-461 for equipment used aboard Navy ships above deck.. The following tests from Part 5 of MIL-STD-461 shall be conducted to determine compliance with the requirement:

- (a) RE101 Radiated emissions, magnetic field, 30 Hz to 100 kHz.
- (b) RE102 Radiated emissions, electric field, 10 kHz to 18 GHz
- (c) RS101 Radiated susceptibility, magnetic field, 30 Hz to 100 kHz
- (d) RS103 Radiated susceptibility, electric field, 2 MHz to 40 GHz

In addition the CV Crane shall operate within specifications when subjected to a government controlled radiated susceptibility test using the electromagnetic environments found in MIL-HDBK-235-2, Table Va.

3.3.8 External lighting. CV Crane shall have sufficient external lighting to effectively light the hook, load, boom and cab area as well as the surrounding crane perimeter for safe deck movement and positioning.

3.3.9 Servicing. The CV Crane shall have inspection covers and access for daily maintenance that fasten securely in place but are easily accessed without the use of tools

3.3.10 Pusher plate and drive train. To permit jettisoning a crashed aircraft over-the-side, the CV Crane shall be equipped with a pusher plate and drive train capable of exerting 10,000-pound horizontal load. The pusher plate shall remain attached to the CV Crane during the CV Cranes use. The pusher plate shall not interfere with any of the CV Cranes craning functions.

3.3.11 Outfitting. The CV Crane shall be equipped with the following accessories:

- (a) Horn
- (b) Dome Light
- (c) Rear and Side View Mirrors
- (d) Electric Windshield Wiper/ Washer
- (e) Defroster
- (f) Tachometer
- (g) Backup Alarm

- (h) Audible Swing Alarm
- (i) Top Hatch Window Wiper
- (j) Cab Air Conditioning
- (k) Cab Heater

3.3.12 Wire rope. The wire rope shall be in accordance with Federal Specification RR-W-410. The wire rope shall have a minimum safety factor of 5.0 based on the wire rope's minimum breaking strength.

3.3.13 Dead man controls. The crane controls shall be return to center, dead man type.

3.3.14 Controlled lowering. The crane shall have controlled lowering when in normal operating mode, that is, dynamic braking shall be accomplished by the control/hydraulic system.

3.3.15 Mechanical holding brake. The mechanical holding brake shall be interlocked with the main hoist motor so that the brake shall set when any of the following conditions occur:

- (a) Main hoist motor is stopped
- (b) Failure of electrical power
- (c) Loss of hydraulic pressure

3.3.16 Electrical maritime. All electrical cabling, connection boxes, motor, power supplies, controller, electronic controls, sensors, switches and circuit breakers shall be compatible with maritime service and shall meet inspection criteria of ASME 30.5 – 2000.

3.3.17 Outriggers. The use of outriggers is allowed in order to perform the lifts listed in tables 3-2 and 3-3 provided the loads imposed on the deck of the ship by the outriggers do not exceed the allowable loads as described in paragraph 3.5.7. The use of rolling outriggers will be considered acceptable to perform the "Hoist & Travel" lifts listed in table 3-2 provided use of the outriggers do not increase the outreach required to perform the listed lifts and the loads imposed on the deck of the ship by the rolling outriggers do not exceed the allowable loads as described in paragraph 3.5.7. If rolling outriggers are used to perform the "Hoist & Travel" lifts listed in table 3-2 the CV Crane must still meet the turning radius requirements of paragraph 3.5.2 while performing these lifts on rolling outriggers.

3.3.18 Control features. The crane shall incorporate control features, which in the event of loss of power will permit the operator to lower a boat, or other load, by brake-controlled gravity means only. The operator shall be able to stop the load when desired. The maximum lowering speed shall not exceed 100 feet per minute.

3.3.19 Dynamic travel controls. The crane shall have controls that will allow for a gradual acceleration and deceleration at normal travel speeds with a load attached.

3.3.20 Length of wire rope. With the crane on the flight deck and the boom topped up and extended, there shall be enough wire rope for the hook to reach the waterline with 2½ wraps remaining on the drum. Assume the waterline to be 75 feet below the flight deck.

3.3.21 Hydraulic system. The hydraulic system shall not overheat in the operating conditions described in 3.3.8.

3.3.22 Diesel engine. The diesel engine shall operate for prolonged periods no load / idle per the duty cycle described in paragraph 3.3.6 with no detrimental effects or increase in maintenance as a result of the long idle periods. The diesel engine's fuel tank shall be large enough to provide a minimum run time of 8 hours without refueling while being operated as described in 3.3.8. Cold weather starting of diesel engines shall be required without utilizing ether. The diesel engine shall be capable of running on the following fuels:

- (a) Diesel fuel compatible with VV-F-800,
- (b) JP-5 Aviation fuel (refer to MIL-DTL-5624)
- (c) JP-8 Aviation fuel (refer to MIL-DTL-83133).

3.3.23 Hook characteristics. In order to accommodate the terminal ring or link of the aircraft hoisting sling, the trapezoidal section of the major dimensions of the crane's hoist hook shall not exceed 7 inches by 4.5 inches as shown in Figure 3-1.

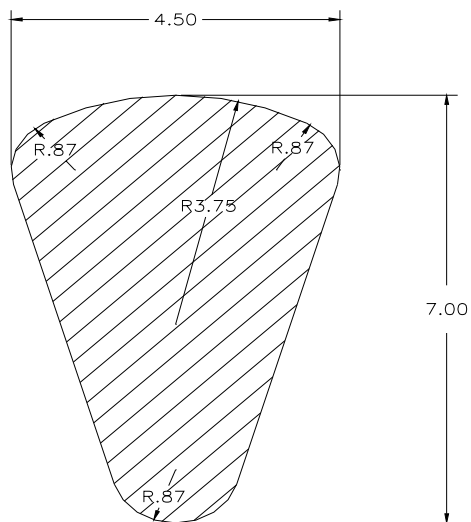


FIGURE 3-1. Trapezoidal Section of Crane Hook.

3.3.24 Towing attachments. The crane shall be equipped with pintle assemblies in accordance with Commercial Item Description A-A-52550 Type II (40,000 pounds max GTW) front and rear. The pintle assemblies shall be mounted on the crane's longitudinal centerline approximately 24 inches above ground level.

3.3.25 Lifting attachments. The crane shall be provided with suitable lifting attachments to enable the crane to be lifted perpendicular to flight deck as the crane would be oriented during normal operations. The attachments shall be located such that, adequate clearance will exist between lifting slings and all exterior parts of the equipment when the crane is hoisted. The attachments for multiple slings shall be designed so that the attached slings will converge at a point not to exceed 19 feet above the lowest extremity of the load, when such limitation is possible. Lifting attachments shall be positioned in such direction that the lifting strain will be in line with the longitudinal axis (peripheral plane) of the eye of the attachment. The eye of each lifting attachment shall not be less than 3 inches inside diameter.

3.3.26 Tiedown attachments. The crane shall be provided with tiedown eyes and a pattern for using the ships deck sockets for lashing the crane to the deck of the ship. The tiedown eyes shall be of such design, location and number to enable the crane to be secured in such a manner as to prevent shifting or movement in any direction when subjected to the ship's motions as defined in paragraph 3.4.3. Additionally, the crane vendor shall provide the grid pattern dimensional requirements for the using the ships deck sockets for four 10,000-pound capacity opposing chain tiedowns, to be used for added safety when handling boats over the side. The inside diameter of each tiedown eye shall be at least three inches and all edges of the eye shall have a minimum radius of 1/8-inch. MIL-STD-209 shall be used for guidance.

3.3.27 Stabilizing Line Attachment. The CV Crane shall include attachment points to which load stabilizing lines can be attached while performing both the aircraft "Hoist & Travel" and "Hoist & Slew" lifts listed in table 3-2 and the boat lifts listed in table 3-3.

3.3.28 Capacity charts. There shall be capacity charts provided for the CV Crane in normal (at sea) operating conditions. These charts shall list rated load/outreach capacities and list sea motion and wind limitations for operation. A waterproof copy shall be located in the operator's cab.

3.4 Environmental conditions.

3.4.1 Weather conditions. The CV Crane shall be capable of operation / storage within the ambient conditions described below:

- (a) The CV Crane shall be designed to operate in all temperatures ranging from -32 degrees Celsius (-25 degrees Fahrenheit) through 52 degrees Celsius (125 degrees Fahrenheit).
- (b) The CV Crane shall designed to stored at all temperatures ranging from -40 degrees Celsius (-40 degrees Fahrenheit) through 60 degrees Celsius (140 degrees Fahrenheit).
- (c) The CV Crane shall be designed to operate in rainfall at the rate of 2 inches per hour at a wind velocity of 25 knots.

- (d) The CV Crane shall be designed to be stored in rainfall at the rate of 5.2 inches per hour at a wind velocity of 80 knots.
- (e) The CV Crane shall be designed to operate in 100% relative humidity.
- (f) The CV Crane shall be designed to operate with exposure to a five percent salt solution, with a fallout rate of 1.2 fluid ounces of salt solution per hour per ft² of horizontal surface area.

3.4.2 Ship motion and wind conditions for normal operations. The crane shall be designed to hoist at all load/radius combinations specified in Tables 3-1 and 3-2 using normal operating condition load factors specified as follows:

- (a) 25 knot wind speed
- (b) Horizontal Acceleration: $0.31g's^1$
- (c) Vertical Acceleration: $1.00 \pm 0.41g's$ (1.41g's maximum, 0.59g's minimum).

The following criteria and conditions shall be met:

- (a) The crane shall meet the structural and stability requirements of ASME B30.5 while being subjected to the above load factors.
- (b) Wind force plus all acceleration forces occur simultaneously. Wind force and horizontal acceleration shall be assumed to be in the same direction.
- (c) Shape factor (C_d) for projected area (i.e., sail area) of aircraft and boats shall be assumed to be not less than 1.3.
- (d) Shape factor (C_d) for projected area of crane shall be rationally determined but in no case shall the aggregate shape factor be less than 1.4.
- (e) The horizontal acceleration shall be considered in all critical directions relative to the boom. Stability could be one limiting factor, while structural strength is a limiting factor in a different direction.

3.4.3 Ship motion and wind conditions for crane stowed. The crane shall be designed to withstand Storm Condition load factors specified as follows:

- (a) 30 psf wind force on the projected area
- (b) Longitudinal Acceleration: $0.36g's$
- (c) Transverse Acceleration: $0.69g's$
- (d) Vertical Acceleration: $1.00 \pm 0.43g's$ (1.43g's maximum, 0.57g's minimum).

The following criteria and conditions shall apply:

- (a) Wind force plus acceleration forces for all three axis occur simultaneously.
- (b) Vertical acceleration is at the specified minimum value.

¹ g's represents acceleration of gravity, where $1g's = 32.2 \text{ ft/sec}^2$, i.e. Horizontal Acceleration = $0.31(32.2) = 9.98 \text{ ft/sec}^2$

(c) No frictional resistance between tires and the deck.

3.4.4 Shock. The crane shall meet the Grade “A”, Class I, Heavy shock requirements as defined in MIL-S-901.

3.5 Performance Characteristics.

3.5.1 Size. The CV Crane shall not exceed 34.5 feet in length, 18.5 feet in height and 15 feet in width with the outriggers retracted.

3.5.2 Turning Radius. The CV Crane shall have a maximum turning radius of 35 feet.

3.5.3 Speed. The CV Crane shall have a travel speed of 0 – 10 mph while traveling with no load. The CV Crane shall have a travel speed of 0 – 3 mph while traveling with the maximum load.

3.5.4 Braking. In addition the braking requirements contained in ASME B30.5, the service brakes shall be able to smoothly bring the fully loaded crane to a complete stop in a distance of 10 feet or less from the maximum fully loaded speed of 3 mph. This shall be able to be accomplished while subjected to conditions described in paragraph 3.4.2

3.5.5 Slewing. If the CV Crane satisfies the requirements of lifting all the aircraft listed in Table 3-2 at the weights listed in the “Hoist and Slew” column by slewing (and not by “Hoisting and Traveling”), the CV Crane shall be capable of slewing all aircraft listed at the “Hoist and Slew” weights 360 degrees while the CV Crane is 4 degrees from level and also subjected to the conditions described in paragraph 3.4.2.

3.5.6 Weight. The CV Crane configured, ready to hoist an aircraft shall not exceed 125,000 pounds.

3.5.7 Deck loading. The CV Crane shall not exceed the allowable deck loading shown in Figures 3-2 and 3-3. These criteria apply to tires and outrigger pads alike. The allowable deck loading shall apply to all specified load/radius combinations for normal operations with the ship motion and wind conditions as specified in paragraph 3.4.2 with the boom in the least favorable direction. The allowable deck loading shall also apply to the stowed condition with the ship motion and wind conditions as specified in paragraph 3.4.3.

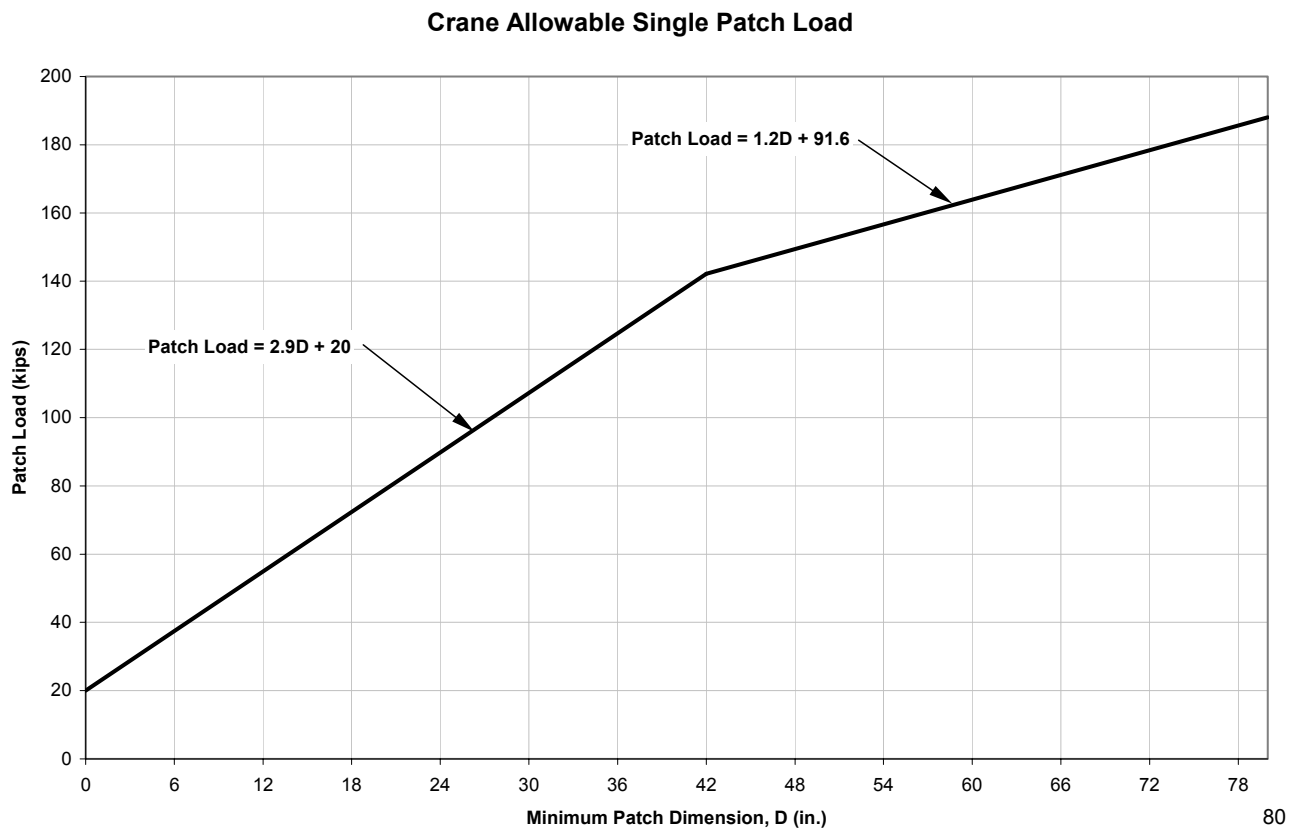


FIGURE 3-2. Crane Allowable Single Patch Load.

Note: 1. Key Patch Dimension is defined as the smaller of the two sides of the rectangular contact area.

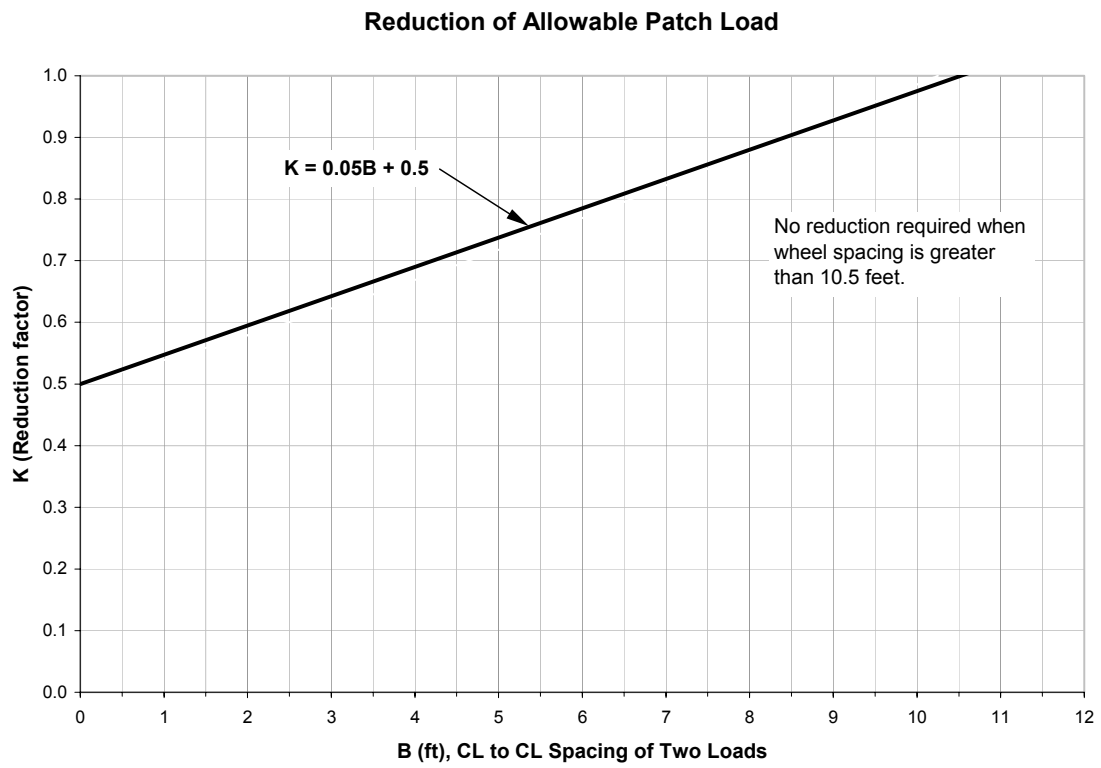


FIGURE 3-3. Reduction of Allowable Patch Load.

3.5.8 Boat Handling and Recovery Capabilities

3.5.8.1 Launching and Recovering. With CV Crane on the flight deck the crane shall be capable of launching and recovering boats to and from Aircraft Elevator # 3 and #4 while the elevator is at the hangar deck level in the condition describe in 3.4.2.

3.5.8.2 Emergency Controlled Boat Lowering . The CV Crane shall be capable of performing an emergency controlled lowering a 24,000 lbs load at a max speed of no more than 100 ft per min.

3.5.8.3 Crane hook or fall block shall have at least two opposing tag line attachment rings in order to position and stabilize the crane hook.

3.5.9 Paint. CV Crane components shall be pre-painted prior to assembly utilizing a process that conjoins resin and a common hardener to produce a tough, tenacious adhering film. “The following finish and coating characteristics are required:

- (a) Coatings shall contain no pigments in concentrations that will render the coating residues toxic during application or removal.
- (b) The finished, cured coatings shall exhibit adequate corrosion protection to protect the equipment against general corrosion during exposure to a marine environment and shall be resistant to underfilm corrosion and other defects, such as blistering, caused by this exposure.
- (c) The finished, cured coatings shall be resistant to color change from exposure to ultraviolet or sun light.
- (d) The finished, cured coatings shall be resistant to abrasion, impact, and degradation from fluids and lubricants likely to be encountered by the equipment.

The use of powder coatings is preferred. Consideration will be given to CV Crane designs that incorporate powder coatings to the maximum extent possible. The following specifications conform to typical Navy powder coating operations and are provided for guidance only:

- (e) RECOMMENDED PRETREATMENT: Abrasive blasting with reusable or recyclable material
- (f) RECOMMENDED COATING: Triglycidyl isocyanurate (TGIC) resin, with finished color meeting the characteristics of Color No. 27925 of FED-STD-595
- (g) RECOMMENDED THICKNESS: In accordance with the coatings manufacturer’s direction, consistent with providing adequate protection from corrosion and damage. In general, 2 mils (minimum) for thin-gauge parts used in dry service applications and 4 mils (minimum) for thick parts used in wet space applications.

On components where powder coating is not employed, the Crane should be finished and coated using an epoxy primer and a polyurethane topcoat. The primer shall have a maximum volatile organic compound (VOC) content of 420 grams/liter (3.5 pounds/gallon). The topcoat shall have a maximum VOC content of 340 grams/liter (2.8 pounds/gallon). Consideration will be given to EI that uses coatings with the minimum VOC content possible. The following specifications meet these requirements and are provided for guidance only:

- (h) RECOMMENDED PRETREATMENT: MIL-C-29602
Recommended Alternate: SAE-AMS1640
- (i) RECOMMENDED PRIMER: Epoxy Coating MIL-P-53022, Type II
Recommended Alternate: Epoxy, Water-Reducible MIL-P-53030
- (j) RECOMMENDED TOPCOAT: Polyurethane MIL-PRF-85285, Type II,
Color No. 27925 of FED-STD-595
Recommended Alternate: Epoxy MIL-PRF-22750, Type I,

3.6 Support equipment. The design of the crane shall be such that the requirements for special tools or support equipment shall be minimized.

3.7 Stenciling. The gross weight and serial number of the vehicle shall be stenciled on the unit in such a manner as to be readily discernible. The prescribed tire pressure, if applicable, shall be stenciled on the vehicle near each tire using block or stencil type letters not more than one inch high. The fluid type and capacity shall be stenciled on the vehicle adjacent to the servicing cap or opening. Fuel stencil height shall be not less than two inches. Stenciling shall be gloss black, color number 17038 of FED-STD-595.

3.8 Retro-Reflective Marking. The vehicle shall be marked with retro-reflective material in accordance with SAE AS81807. Reflective tape shall be in accordance with ASTM D 4956, Type II, Class 1, color yellow.

3.9 Identification Marking. The vehicle shall be identified in accordance with MIL-STD-130G. The identification plate shall conform to MIL-DTL-15024, Type H, Style III. A modification plate shall conform to Naval Air Engineering drawing 5SE00363-3. Plates shall be located so that they are clearly visible.

3.10 Instruction and Transportation Plates. Instruction and transportation plates shall conform to MIL-DTL-15024, Type H, Style III. Instruction plates shall be suitable located, shall contain clear concise instruction for the operation of all controls, and shall describe the procedure to be followed in servicing the vehicle. Transportation plates shall be inscribed with a diagram showing the lifting attachment and lifting slings, the capacity of each attachment, and the required length and size of each sling cable. A silhouette of the vehicle showing location of the center of gravity shall be provided on the transportation plate. In addition a plate shall be provided that shows the type, quantities and locations of tiedown eyes, tiedown lashings and deck sockets required to secure the crane.

3.11 Hazmat Management. The contractor shall, where possible, eliminate or reduce hazardous material from the system and its manufacturing processes, and shall properly control hazardous materials that are not eliminated, as required by the applicable paragraphs of the SOW.

Hazardous and environmentally unacceptable material, for the purpose of this contract, is defined as any material that:

- a) Is regulated as a Hazardous Material per 49 CFR 173.2, or
- b) Requires a Material Safety Data Sheet (MSDS) per 29 CFR 1910.1200, or
- c) During end use, treatment, handling, packaging, storage, transportation, or disposal meets or has the potential to meet the definition of a Hazardous Waste as defined by 40 CFR 261 Subparts A, B, C, or D, or
- d) Is regulated as an Ozone Depleting Substance (ODS) per 40 CFR 82 Subpart A, Appendices A and B, or
- e) Is identified in the Clean Air Act, Chapter 85, Subchapter I – 7412, as a Hazardous Air Pollutant.

3.12 Hazmat Prohibitions.

- a) Magnesium shall not be used in the construction of the CV Crane.
- b) Asbestos material shall not be used in the construction of the CV Crane.
- c) Beryllium shall not be used in the construction of the CV Crane.

3.13 Reliability Requirements (Threshold Requirement). The CV Crane shall have a Mean Time Between Critical Operational Failures (MTBCOF) of not less than 897 hours.

3.14 Reliability Requirements (Objective Requirement). It is desired the CV Crane have a Mean Time Between Critical Operational Failures (MTBCOF) of not less than 1080 hours.

3.15 Maintainability Requirements. The Mean Time To Repair (MTTR) shall be not greater than four (4) hours, as determined by Corrective Maintenance (CM) actions performed by the embarked Intermediate Maintenance level (I-level). The total repair time for CM actions shall consist of the sum of the times of each subtask element comprising the CM action. The total CM repair time shall include: fault detection (localization and isolation), removal and replacement of the failed component, calibration and/or alignment (if required), replenishment with required working fluids/substances, and validation (checkout) of the repair. Easily removable panels (secured by latches) shall be provided to facilitate access to components for maintenance and servicing of hydraulic fluid, fuel, water and oil. The Contractor shall provide a recommended lubrication and preventative maintenance chart tailored to the CV Crane, based on the expected operating scenario. The chart shall include all daily, weekly, monthly, quarterly, semiannual and annual maintenance requirements. Maintenance designed for

specific periods shall be the preferred maintenance methodology; however, situational-based maintenance shall be permitted.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Classification of Tests. The inspection and testing of the CV Crane shall include Developmental Test & Evaluation (DT&E), Operational Test & Evaluation (OPEVAL) and Production Acceptance tests.

4.2 Test Equipment. Test and measuring equipment shall, as a minimum, adhere to the requirements of ANSI/NCSL Z540-1, ISO 10012-1 or equivalent.

4.3 Test Measurements. Unless otherwise specified, all measurements shall be made at the following standard, ambient conditions.

Temperature:	$25^{\circ}\text{C} \pm 10^{\circ}\text{C}$ ($77^{\circ}\text{F} \pm 18^{\circ}\text{F}$)
Relative humidity:	Uncontrolled room ambient
Atmospheric pressure:	Site pressure

4.4 DT&E. DT&E shall be conducted in two phases; Contractor tests and Government tests.

4.4.1 Contractor Tests. The contractor shall demonstrate, to the satisfaction of the procuring activity, the ability of a pilot production unit to meet all requirements in Section 3 with the exception of actually lifting aircraft and boats. The Contractor shall simulate the aircraft and boats with dead weights for all tests. Tests, analysis or inspections will be required to validate each Section 3 requirement, however the following tests must be included. The weights listed below are based on threshold values. If the CV Crane is offered with greater capabilities than the threshold, the test values shall be adjusted to match those capabilities.

4.4.1.1 Production Acceptance Tests. DT&E testing of the pre-production units will include the production acceptance tests required under paragraph 4.6.

4.4.1.2 Electromagnetic Compatability Testing. EMC testing is to be conducted in accordance with MIL-STD-461 for compliance with the requirements of Paragraph 3.3.7.

4.4.1.3 Environmental Testing. The crane shall be tested in accordance with MIL-STD-810F for compliance with paragraph 3.4.1.

4.4.1.4 Dynamic Hoisting and Stability Test. The crane shall be tested to verify that it can hoist the aircraft listed in table 3-2 at the weights and outreaches listed while both the crane and the aircraft are subjected to the conditions of paragraph 3.4.2. This shall be accomplished by using 110% of the load calculated to meet the conditions of paragraph 3.4.2.

4.4.1.5 Slewing. If the CV Crane satisfies the requirements of lifting all the aircraft listed in Table 3-2 at the weights listed in the “Hoist and Slew” column by slewing (and not by

“Hoisting and Traveling”), the CV Crane shall be tested by slewing the equivalent dynamic weights of all aircraft listed at the “Hoist and Slew” weights 360 degrees while the CV Crane is 4 degrees from level and also subjected to the conditions described in paragraph 3.4.2. This shall be accomplished by using 110% of the load calculated to meet the conditions of paragraph 3.4.2.

4.4.1.6 Traveling. The CV Crane shall be tested for travel capability by travelling with the most severe weight and outreach combination or combinations in Table 3-2 Hoist and Travel Weight column at a speed of 3 MPH. The crane shall travel at least 100 feet and turn 180 degrees through a 35 foot radius during the test. The weight suspended from the crane shall be the same weight used in the Dynamic Hoist and Stability test.

4.4.2 Government Tests. The lifting and handling of boats and aircraft shall be accomplished during the Government phase.

4.4.2.1 Boat Handling Testing Requirements

4.4.2.1.1 Static Load Test. The CV Crane shall show that it can hold statically load of 48,000 lbs at an outreach of 17 ft from the crane. (note: if this is shown in any other crane test it is then not necessary to add a specific test here.)

4.4.2.1.2 Dynamic Load Test. The CV Crane shall show that it can lift a and lower a minimum dynamic load of 30,000 lbs stopping at least 3 times in each direction.

4.4.2.1.3 Emergency Load Lowering. Show crane can do an emergency controlled lowering with the heaviest boat (24,000 lbs) at allowable speed of no more than 100 ft/min.

4.4.2.2 Flight Deck EMI Compatability. The CV Crane will be subjected to a government controlled radiated susceptibility test using the electromagenetic environments found in MIL-HDBK-235-2, Table Va.

4.4.2.3 Maintainability Demonstration (MDEMO). The Government shall conduct a Maintenance Demonstration (MDEMO) using the Pilot Production Test Procedures and preliminary Technical Manual. The MDEMO shall demonstrate the ability of maintainers to meet MTTR requirements in paragraph 3.14 and assist in the adequacy review of procedures presented in the preliminary Technical Manual. Any problems encountered during this MDEMO will be brought to the attention of the Contractor for resolution between the Government and the Contractor. The MDEMO shall include, but is not limited to, all scheduled maintenance actions and a selection of unscheduled maintenance actions that will be determined by the Government.

4.5 OT&E. Operational Tests and Evaluation shall be conducted by COMOPTEVFOR.

4.6 Production Acceptance Tests. Production units shall in all respects, including design, construction, workmanship, performance and quality, be equivalent to the approved pilot-

production test units. The contractor shall demonstrate, to the satisfaction of the procuring activity, the ability of the production units to meet all requirements in Section 3. In the event that any of the production units fail a test or do not meet the requirements of Section 3 it shall be the obligation of the contractor to make necessary corrections as approved by the procuring activity. These tests shall include, but not be limited to, the tests in 4.6.

4.6.1 Examination of Product. The unit shall be visually inspected for conformance to the material and workmanship requirements. The inspection shall be performed prior to any testing, and as a minimum, encompass the following areas:

- Completeness
- Nameplate and identification markings
- Finish
- Fastening and securing devices
- Welded joints
- Harnesses and other wiring
- Lighting(Interior & Exterior)
- Retro-reflective marking
- Horn
- Rear and Side View mirrors
- Electric Windshield Wiper/Washer
- Defroster
- Tachometer
- Backup Alarm
- Audible Swing Alarm
- Top Hatch Window Wiper
- Air Conditioning
- Cab Heater
- Front Tow Hitch
- Lifting Eyes
- Capacity Charts

4.6.2. Dead man controls. The CV Crane controls shall return to center, dead man type

4.6.3 Speed. It shall be demonstrated that the CV Crane has a travel speed of 0-10 MPH while traveling with no load and a speed of 0-3 MPH while traveling with the maximum load. A fifth wheel shall be used to record speed.

4.6.4 Dynamic Hoisting and Stability Test. Each crane shall be tested to verify that it can hoist the aircraft listed in table 3-2 at the weights and outreaches listed while both the crane and the aircraft are subjected to the conditions of paragraph 3.4.2. This shall be accomplished by using 110% of the load calculated to meet the conditions of paragraph 3.4.2.

4.6.5 Hoist and Slew. Each CV Crane shall be tested by slewing the equivalent dynamic weights of all aircraft listed at the “Hoist and Slew” weights 360 degrees while the CV Crane is 4 degrees from level and also subjected to the conditions described in paragraph 3.4.2. This shall be accomplished by using 110% of the load calculated to meet the conditions of paragraph 3.4.2.

4.6.6 Turning Radius. It shall be demonstrated that the wall-to-wall turning diameter is 35 feet or less. The CV Crane is to be driven at idle speed in the tightest right turn possible for one complete turn then repeated while a stick marker attached to the outer front fender contacts the surface. The measured diameter shall be less than 35 feet. Repeat the above procedure making a left turn.

4.6.7 Controlled lowering. It shall be demonstrated that the CV Crane has controlled lowering when in normal operating mode, that is, dynamic braking shall be accomplished by the control/hydraulic system.

4.6.8 Mechanical holding brake. It shall be demonstrated that the mechanical holding brake be interlocked with the main hoist motor so that the brake shall be set when any of the following conditions occur:

- (a) Main hoist motor is stopped.
- (b) Failure of electrical power.
- (c) Loss of hydraulic pressure.

4.6.9 Emergency load lowering. It shall be demonstrated that emergency load lowering feature in case of power failure will permit operator to lower the load by controlled gravity means. The operator shall be able to stop the load when desired and that maximum lowering speed does not exceed 100 feet per minute.

4.7 Preventive Maintenance. Only the preventive maintenance procedures specified for the equipment during service use and listed in the approved test procedures shall be performed during the test program.

4.8 Post Test Examination. The CV Crane shall undergo an inspection to determine if any failures or pending failures have occurred. This includes but is not limited to a visual inspection of the CV Crane for excessive wear, inspection of fluid filters for wear particles and deformation of structures.